Don Lancaster's

Tech Musings

January, 1999

Remote control your cat!
Creating semi-log graphs
Some Tesla book references
Hydrogen absurdities exposed
Visual luminosity measurement

We seem to have a wild mix of topics this month, so let us just jump right in. We might start our quest by taking a look at…

Visual Lumonisity

Light is electromagnetic radiation at incredibly high frequencies. Using up just under an octave's bandwidth between high frequency blue around 400 nanometers wavelength and low frequency red somewhat under 700 nanometers.

Things get real sticky in a hurry when you try to measure light. Do you as an astronomer want to know the exact amount of energy received? If so, you should be interested in the *brightness* of a source. If, instead, as an architect, you'll want to know the amount of energy *perceived by the human eye*. Then you are interested in the *luminosity* of a source.

The human eye long ago adapted itself to center its response on solar radiation, combined with foilage and sky reflections. Figure one shows the Standard Observer Luminosity Curve otherwise known as the "standard eyeball". We see that the eye is best at seeing green, and poorer at red and blue, tapering off to zero at the visual band limits. Crudely, it takes five or so parts of blue or two parts of red to equal one part of green.

Here is a more specific (but rather phosphor-dependent) formula used by PostScript and NTSC tv…

gray = 0.60 green +
0.29 red +
0.11 blue

A luminosity measuring scheme is shown in figure two. You focus upon your intended surface or source and then run through a special calibrated filter that converts "raw" broadband sensor response into the desired CIE response. Exact alibration curves are provided for each sensor.

The *Tektronix* J6523 narrow angle luminance probe is a good example.It can be used with their J-16 digital photometer, or else can be adapted to most any DVM or data acquisition system. More info on this potent instrument front end appears at my *www.tinaja.com/bargte01.html*

And more info on getting colors to print properly as grays is found in my *www.tinaja.com/acrob01.html*

Shattering Some Hydrogen Myths

There's some outrageous postings knocking around the web these days that I feel I must comment on. Two of these involve hydrogen energy, so let's take a closer look.

The first claim is that if you ignite a stochiometric mixture of hydrogen and oxygen, instead of exploding, an "implosion" occurs and a vacuum of *sixty three* inches of mercury results!

Well, a vacuum is simply nothing. There is no known way to get less than nothing. Yes, you might be able to owe money but no way is known to owe mass.

Package a one square inch column of all the air directly above you and weigh it under earth gravity. You'll find it measures something like 14.7 pounds. Equal to around 39 inches of mercury or 32 feet of water.

Now, empty a solid box, creating a "fairly good" vacuum. The resultant pressure will be 14.7 psi. Now build a "darn good" vacuum. How does the pressure on the box change?

So little that you'll barely notice!

Next, build up a "perfect" vacuum. Your pressure will change even less. Since you can't get less than nothing, no way can you get a vacuum better than 39 inches of mercury.

For similar reasons, the ultimate limit on a lift pump or a drafting fire engine is 32 feet at sea level. But in practice, 24 feet is the best you will usually be able to do.

You can't suck out something that is not there!

Wait. It gets even worse. Put some water in your reduced pressure box. A fraction of your liquid water will rapidly convert to its vapor phase. Figure three shows you how the

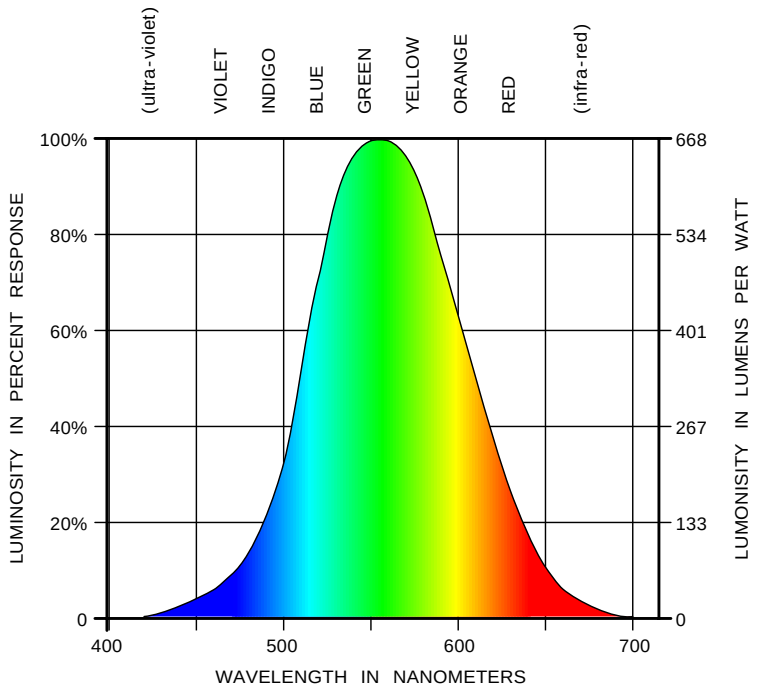

Fig. 1 – STANDARD LUMINOSITY CURVE shows how human perception of light intensity varies with color and frequency.

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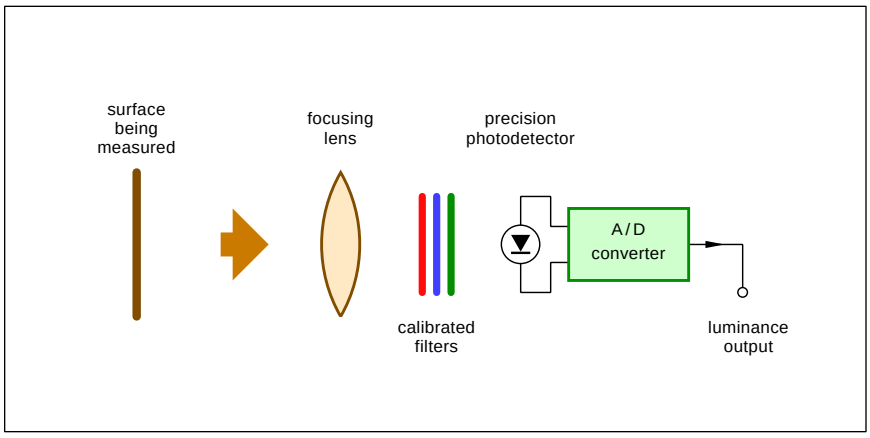

Fig. 2 – LUMINOSITY IS MEASURED by imaging a surface, careful filtering, precision photodetection and A/D conversion. The Tektronix J6523 is a typical instrument front end.

vapor pressure of water varies with your temperature. Somewhat above room temperature, the vapor pressure of water is around *one* pound per square inch.

Thus, there is *no way* to create a vacuum of less than one psi in any box which still contains warm liquid water! Especially if the only activity creating the reduced pressure in the first place is water condensation.

What about the implosion part?

What usually happens is a normal explosion *sometimes* followed up by condensation of the vapor into liquid water. Yes, the final pressure can end up less than atmospheric. But if you repeat this experiment several times, things will warm up, and this curious reduced pressure disappears. Above the boiling point of water, you should usually get an explosion only.

This sometimes reduced pressure can create severe safety problems. Especially when an unarrested flame gets sucked back into a tank, hoses, or an electrolyzer. One "free energy" proponent recently and dramatically verified this experiment.

Much more on amateur vacuum techniques is in Steve Hansen's *Bell Jar* and at his supporting website of *www.tiac.net/users/shansen/belljar*

Another outrageous claim is that it

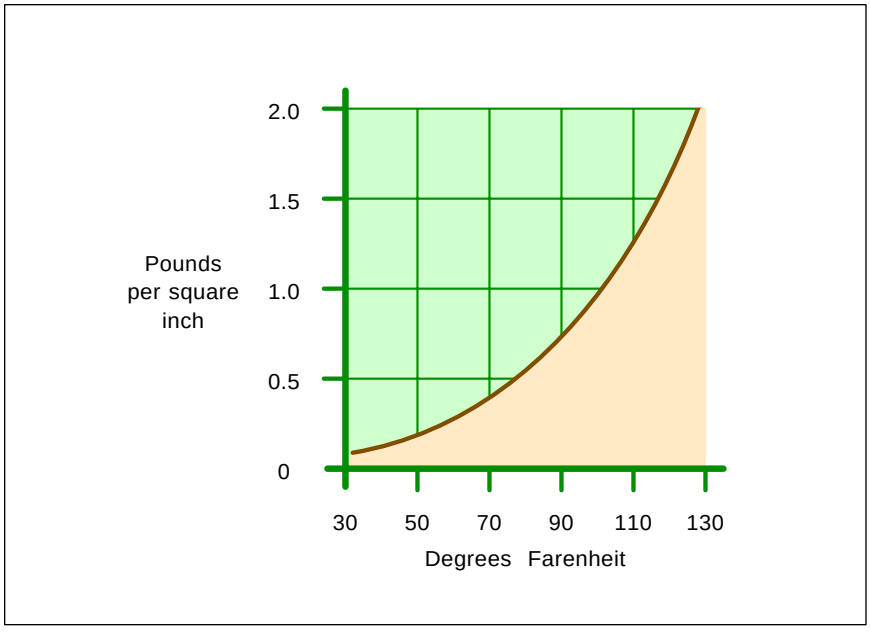

Fig. 3 – HOW THE VAPOR PRESSURE OF WATER varies with temperature. When warm water remains present, only weak vacuum can be created.

is simple, cheap, and easy for solar electricity to generate hydrogen.

Well, yeah, solar cells output low voltage dc. Electrolysis needs low voltage dc. While hydrogen storage nicely averages out day and night. So the two eventually should provide an interesting match. We saw how the NREL paper in *Science* for April 17, 1998, pp 425-427 doubled the usual solar-to-H2 effficiency with a direct conversion process. But still using only uneconomic materials.

Sadly, generating hydrogen is not the problem. There's much better and cheaper ways to make hydrogen that do *not* use water electrolysis. Your key unsolved problems are dense and efficient storage, user safety issues, and long life engines or cost effective fuel cells. Nonetheless, let us run a quick reality check…

Say you have a large 400 watt solar panel? How much hydrogen can you generate how fast? Well there's 9600 watt hours per liter in gasoline, and 3.5 watt hours energy per liter in STP hydrogen. Allowing for inefficiency, figure around 15 kilowatt hours off the panel for the hydrogen equivalent of one *liter* of gasoline.

Or needing well over *one week* per hydrogen equivalent *gallon* of gas!

Weather permitting.

The key problem here is that solar energy is very diffuse and inefficient. Hydrogen energy is also diffuse and inefficient. Combining them using today's tools only makes things much worse. Today, solar electrical energy is still much too valuable to waste on water electrolysis.

Ridiculously so. But do keep on trying, anyway.

More hydrogen tutorials and links at *www.tinaja.com/h2gas01.html*

I Taut I Taw A Puddy Tat

The *Catfinder* from *Curtis Electro Devices* is an cute new variation on mid-range remote controls. You have a small four-channel UHF handheld transmitter and up to four miniature beeping receivers. By attaching the receiver to the cat's collar, you can find Percival Pussival whenever it is time for his bath or a trip to the vet. There's also an 800 tracking number and registration should your cat get stolen, lost, or wander off.

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The unit is also useful for people who continuously lose stuff. Such as remote controls. You simply attach a receiver onto your tv remote and it beeps when you press the Catfinder controller. There's also potential here for wayward grandmothers, smaller children, or disability aides.

Price is $29 for the controller and one receiver, plus $15 for each extra receiver. Receivers are programmed to a particular channel during power up. You hold the selected transmitter button down while you insert the battery into the receiver. The receiver double beeps when programming is complete. The claimed range is fifty to seventy feet, which would cover nearly half an acre. But my own tests did not deliver nearly this range.

I did not look too close, but the circuitry is probably in your typical 350 MHz remote control band. The receivers are superregen or possibly something newer and better, such as time gated TRF. We looked at FCC regulations and circuitry on this back in HACK82.PDF.

The latest versions are now newly waterproofed. Seems the cats quickly discovered that they could defeat the Catfinder by soaking it in their water dish. The issues of finding the cat to install your catfinder or losing your remote have not been addressed.

Catfinder Contest

The Catfinder folks have agreed to a special contest just for readers of this column. Just tell them something unique or unusual you would like to do with one or more Catfinders. They will promptly award a dozen or more free systems to the best entrants.

There's some unique opportunities here. Let's hear them.

Send your written entries to John Curtis by way of the *Curtis Catfinder* address in the *Names&Numbers* box. Or email *jgcurtis@inreach.com*

Do note this is different from our usual contests, so please do *not* send your entries to me, to *Synergetics*, or over to EN editorial.

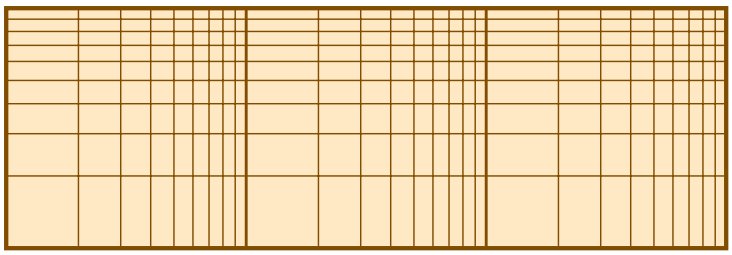
Some Tesla Books

As our resource sidebar for this month, I've gathered together a few of the more credible books that are by or about Nikoli Tesla.

Tesla's development of ac power distribution, induction motors, and transformers was absolutely brilliant. His later day involvement with "free energy" and "earth resonant" sources clearly was not.

Tesla was quite strong in the lab but very weak in underlying theories. While he did experiment with radio and fluorescent lamps, so did many others. Sadly, a fundamentally wrong confusion between a resonant stored energy and actual sourced energy did seem to prevail in his later work.

Sorely misguided latter day cultists have yearned to deify Tesla, claiming lost secrets suppressed by the men in black, free energy results, and even extra-terrestrial origins. Believable hard evidence for these outrageous claims has not been forthcoming.



```
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72 600 div setlinewidth                  % draw log lines
1 1 10 {log 10 mul 0 moveto 0 10 rlineto stroke} for
10 10 100 {log 10 mul 0 moveto 0 10 rlineto stroke} for
100 100 1000 {log 10 mul 0 moveto 0 10 rlineto stroke} for
1 1 10{log 10 mul 0 exch moveto 30 0 rlineto stroke} for

72 300 div setlinewidth                  % emphasize decades
10 0 moveto 0 10 rlineto stroke
20 0 moveto 0 10 rlineto stroke

72 150 div setlinewidth                  % emphasize outlines
0 0 moveto 0 10 rlineto 30 0 rlineto 0 -10 rlineto closepath stroke
grestore

showpage
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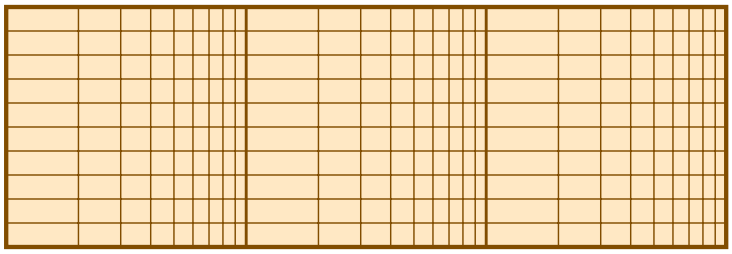

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1 1 10{0 exch moveto 30 0 rlineto stroke} for

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20 0 moveto 0 10 rlineto stroke

72 150 div setlinewidth                  % emphasize outlines
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grestore

showpage
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Fig. 4 – POSTSCRIPT CODE to make log and semilog graphs.

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Those "lots of sparks" Tesla coils were a one time right of passage for technonerds who did not understand or afford girls. But these days, Tesla coils are just an illegal way of taking out a neighbor's tv set. Thousands of man hours of continuing research in EHV transmission and color tv and monitor deflection leaves very little wiggle room for very much new or exciting. Other Tesla developments (such as bladeless turbines) largely remain inefficient lab curiousities.

Did Tesla get the credit he rightly and surely deserved?

For openers, having a fundamental magnetic measurement unit named after you ain't half bad. Innovative originators rarely are recognized. For instance, powered human attended heavier-than-air flight first originated in Australia. Uh, the most important thing the Wright brothers did was *set back* American aviation for decades through all their interminable patent battles on obsolete technology.

It seems Edison had an aggressive propaganda mill which clearly forced Tesla out of the limelight. And for a crucial time, the US was at war with Tesla's native country.

Ongoing title info can be located at *www.tinaja.com/amlink01.html* Always start with the books *by* Tesla, rather than *about* him.

Log Graph Paper

A long time website visitor asked me to repeat how to create your own log, semilog, or other graph paper by using PostScript. Some sample code does show up in figure four. A more detailed example can be found way on back in HACK59.PDF.

What I really find amazing about a PostScript plot or graph is that it can easily do the underlying math.

For instance, your web version of figure one actually calculates out the luminosity curve, giving good color matches. Those decibel conversions, of course, end up trivial. Most of the fancy plots you see in these columns are in fact calculated directly from theory. This can be done once under PostScript-as-language and then is shoved into Distiller to make a fast (and calculaton free) final image.

I've shown the code here in "raw" PostScript. My own PostScript gonzo utilities would normally get used to add power and convenience.

PostScript can be a superb general purpose computer language which is easy to use and scads of fun to play with. Especially for graphics, video, and robotics. Additional details are found at *www.tinaja.com/post01.html* and *www.tinaja.com/acrob01.html*

New Tech Lit

From *Texas Instruments*, the new *Convert Analog* data CD. And from *Microchip Technology*, a new update of their *Technical Library CD*

I just got wind of a new scheme that lets you design your own custom microprocessors, microcontrollers, or DSP's. Ones that do your things your way. The trick is to start with a large and cheap programmable gate array. Such as the XC4005L from *Xilinx* or others. It turns out there is an outfit called *Space-Time Productions* who provide evaluation and configuration cards. Along with lots of free support software in the form of a *Forth* based scripting language.

More DYOP details can be found at *www.tefbbs.com/spacetime/index.html* One DYOP distributor is *Ultra Technology*, whose website is found at *www.dnai.com/~jfox/store.htm* I'll try to do a lot more on this one after I find time for a closer look.

Some interesting castable ceramic products and materials are provided by *Aremco*, while a wide range of gas sensors is offered by *Figaro*.

That little-known and low profile *SPIE* puts on conferences and resells great heaping bunches of first rate optical and sensing technical papers and tutorials available.

Low Cost Electronics Projects is a new Fred Blechman book. Details at *www.tinaja.com/amlink01.html*.

Tiny gas turbines small enough to easily and efficiently replace a size D flashlight cell did appear in *Machine Design* for October 8, 1998 on page 38. A typical premium flashlight cell offers 50 watt hours energy per liter. Gasoline can offer 9600.

A new electrical safety site is up at *www.safetylink.com*

Fluorescent lamp dimmers with a full dimming range are newly offered by *Advance*. A MAX1005 sampler i.c. for digital radio downconversion has been announced by *Maxim*.

Lots of possibilities here.

Biomass & Bioenergy is a scolarly journal from *Elsevier*. *Vacuum Tube Valley* has an interesting and useful mix of historic and modern vacuum tube stuff in it. One useful source for antique amateur and amateur radio manuals is *Infotronix*. More details on finding tech manuals in general at *www.tinaja.com/resbn01.html*

BOOKS ON OR ABOUT NIKOLI TESLA

My Inventions (Nikola Tesla)

Advances in Tesla Technology (Nick Begich)
Fantastic Inventions of Nikola Tesla (David Hatcher)
In Searh of Nikola Tesla (David Peat)
Nikola Tesla: A Spark of Genius (Carol Donnermuth-Costa)
Nikola Tesla's Earthquake Machine (Dale Pond)
Nikola Tesla Returns (Robert Reichtman)
Streams of Lenard and Roentgen (Nikoli Tesla)
TCBA Guide to the Colorado Springs Notes (Richard Hull)
Tesla: Man Out of Time (Margaret Cheney)
Wizard: The Life and Times of Nikola Tesla (Marc Seifer)

For more details, see ***www.tinaja.com/amlink01.html***

NEED HELP?

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NAMES AND NUMBERS

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(708) 390-5000

Aremco
PO Box 429
Ossining NY 10562
(914) 762-0685

Bell Jar
35 Windsor Dr
Amherst NH 03031
(603) 429-0948

Biomass & Bioenergy
PO Box 882
New York NY 10159
(212) 633-3730

Curtis Cat Finder
4345 Pacific Street
Rocklin CA 95677
(800) 337-0901

Figero
PO Box 357
Wilmette IL 60091
(847) 256-3546

Infotronix
PO Box 2045
Waterbury CT 06722
(203) 756-6376

International Rectifier
233 Kansas St
El Segundo CA 90245
(310) 322-3331

Machine Design
1100 Superior Ave
Cleveland OH 44144
(216) 696-7000

Maxim
120 San Gabriel Dr
Sunnyvale CA 94086
(800) 998-8800

Microchip Technology
2355 W Chandler Blvd
Chandler AZ 85224
(602) 786-7200

Science/AAAS
1333 H St NW
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Tektronix
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Beaverton OR 97077
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Texas Instruments
PO Box 809066
Dallas TX 75380
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Ultra Technology
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Berkeley CA 94710
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Vacuum Tube Valley
1095 E Duane Ave Ste 106
Sunnyvale CA 94086
(408) 733-6146 FAX

Xilinx
2100 Logic Dr
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Free samples of FETKY miniature power MOS transistors can be gotten from *International Rectifier*.

For those insider secrets of easily designing your own op-amp filters, read my *Active Filter Cookbook*. By itself or as a portion of my *Lancaster Classics Library*. Find more details per my nearby *Synergetics* ad.

Latest website additions include webmastering secrets, new "virtual ways" *Hexapod* robotic links, 24/7 publishing, a brand new user forum, and much more on military surplus electronics. You'll find all of these at *www.tinaja.com/whtnu01.html*

More on instant technical solutions at *www.tinaja.com/info01.html*

I've got some great new bargains on my surplus web page. Everything from *Tektronix* plug-ins to new a.c. motors to classic Apple collectibles to load banks for windmill testing. You can pick up your free catalog at *www.tinaja.com/bargte01.html*

As usual, most of these mentioned items should appear in our *Names & Numbers* and *Tesla Books* sidebars. Be sure to check here before calling our US technical helpline. ✦

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